ARMY RESEARCH LABORATORY

Determination of Altitude Sickness Risk (DASR) User's Guide

by David P. Sauter and Yasmina Raby

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Army Research Laboratory

White Sands Missile Range, NM 88002-5501

Determination of Altitude Sickness Risk (DASR) User's Guide

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14. ABSTRACT:

Working in high-altitude environments can adversely impact Soldier effectiveness and result in serious health effects or even death. This technical note describes an easy to use mobile application that can be used to provide guidance on these effects.

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1. Introduction

The Determination of Altitude Sickness Risk (DASR) application (app) provides guidance regarding impacts to physical work performance and cognitive performance as well as the risk of altitude illness as a function of environmental, mission, and individual factors. Output is based directly on information found in Table 3-2 in the *Altitude Acclimatization and Illness Management* Technical Bulletin (TB).[1] DASR runs on Android based smart phones (referred to from here on as the "device") and could be readily customized to run on Android tablets as well.

DASR was hosted on the device to address the issue of altitude illness in the military. Availability on a mobile device ensures that critical high-altitude illness guidance is readily available at lower echelons and/or remote locations where laptop or desktop computing platforms and/or network connections back to a higher echelon (from which altitude related information would likely be disseminated) are not available. For a more detailed discussion of mobile Android device relevance to the military see *Android Smartphone Relevance to Military Weather Applications*.[2]

2. DASR Inputs

To launch DASR, simply tap the DASR icon on the device (circled in red, figure 1). The initial input screen is then displayed for the user to enter the Environmental Factors ("ENV") information (figure 2).

DASR is a multiview (a view refers to an individual graphical user interface [GUI] screen) application with a tab bar (see upper portion of figure 2). The user enters the required inputs (default or previously entered values are prefilled) by tabbing through the various views and selecting the fields that he or she wishes to modify. Numeric inputs are checked for appropriate values with a pop-up message displayed to the user in the event that a value is out of range or invalid (e.g., null). The invalid entry is also replaced with the last valid entry. Upon DASR exit, valid input values are saved (via data persistence) for auto-filling entry fields the next time the app is run. Text field inputs (altitude and temperature fields), labels ("Steep, Rugged Terrain?", etc), check boxes ("Carbon Monoxide Heaters?" entry) and "Spinners" (a widget similar to a drop-down list used to select the "Work Rate:" field in figure 3) GUI elements are all used in the DASR app.

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[1] Department of the Army, Headquarters. *Altitude Acclimatization and Illness Management*. Technical Bulletin Medical 505, 2010. http://armypubs.army.mil/med/index.html (accessed 10/29/13).

[2] Sauter, D. *Android Smartphone Relevance to Military Weather Application*; ARL-TR-5793; U.S. Army Research Laboratory: White Sands Missile Range, NM, 2011.

Figure 1. Launch DASR.

Figure 2. Environmental Factors view.

If a Global Positioning System (GPS) capability is present with the device, the altitude value could be automatically retrieved and displayed as the default in the "ENV" view altitude text field box. The temperature value is currently automatically ingested and populated via a Bluetooth connection to a Kestrel handheld weather meter but can be manually entered if a compatible Bluetooth enabled device is not available.

Upon valid entry of the inputs in the "ENV" screen, Physical Work Performance ("P"), Cognitive Performance ("C") and Altitude Illness ("A") risk values will be determined and displayed accordingly as color-keyed indicators under the "RISK IMPACT" column on the right side of the view. The color coding key is displayed at the bottom of the "ENV" view and is valid for subsequent views as well. Thus, in the figure 2 example, for the "Altitude" environmental factor, there is a "Slight to moderate risk" for physical work performance and altitude illness while there is "No risk" for cognitive performance. Likewise, there is a "Significant risk" for physical work performance, cognitive performance, and altitude illness due to the presence of carbon monoxide heaters in the environment.

The next view in the sequence of tabs allows the user to enter the Mission Factors ("MSN", figure 3) affecting the performance impacts and the altitude illness risk. Again, color coding is the same as for the environmental factors. Note, that in this example, there is a beneficial (blue) cognitive performance impact due to the "Duration Above 2400m" value being 3–5 days.

Figure 3. Mission Factors view.

Figure 4 is a screen capture of the Individual Factors ("IND") view used to allow entry of those relevant inputs. The "RISK IMPACT" values are once again determined upon entry of the parameters. Risk and impact level determination for the various factors is relatively intuitive, e.g., there are increased performance impacts and a greater altitude illness risk due to sleep deprivation. TB Medical 505 should be consulted for additional details if necessary.[3]

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[3] See reference 1 on page 1.

Figure 4. Individual Factors view.

The Risk View ("RISK", figure 5) tabulates and displays the cumulative physical work performance, cognitive performance and altitude illness results from the "ENV", "MSN" and "IND" views. Thus, in figure 5, there are a total of four beneficial physical work performance impacts, seven no-risk cognitive performance impacts, etc.
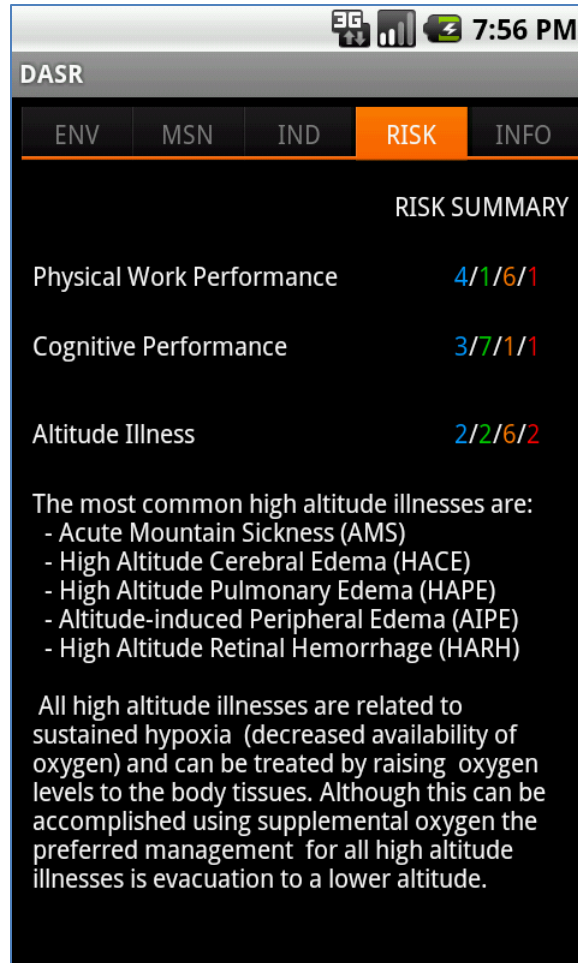
Figure 5. Risk view.

The last view ("INFO") simply provides the Point Of Contact information for the app as well as the version and date of the app.
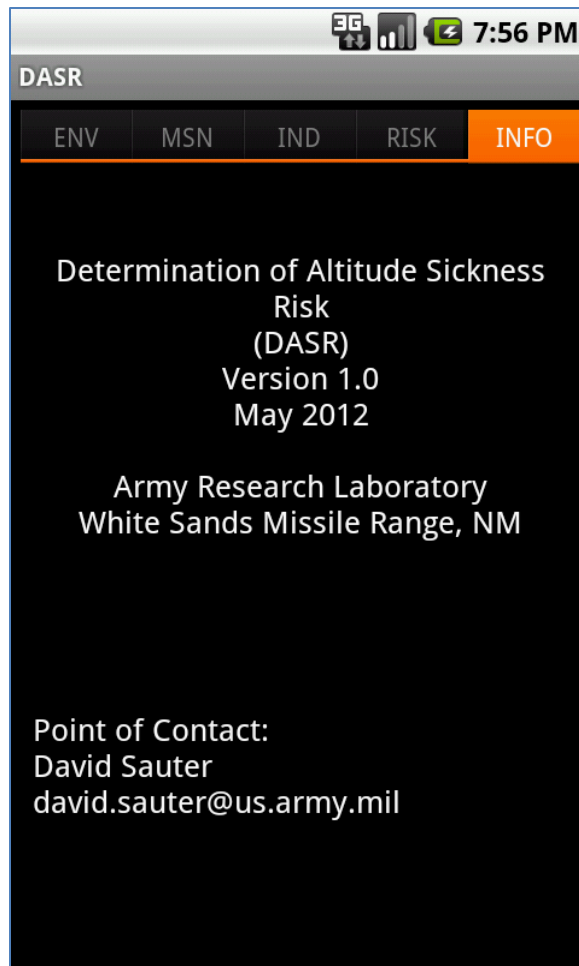
Figure 6. Information view.

3. Summary

DASR provides easy to use and readily understood guidance regarding physical performance and cognitive performance impacts as well as the risk of altitude illness to Soldiers. Hosting on a mobile device should make it accessible virtually anywhere in a tactical or training environment.

Final internal testing and evaluation of DASR is anticipated in 2014. It will then be transitioned to the Defense Information Systems Agency's (DISA) Mobile Application Store (MAS), which is slated for deployment in the summer of 2014. Via the MAS, Department of Defense (DOD) individuals will be allowed access to the DASR app for their use.

List of Symbols, Abbreviations, and Acronyms

"A"   Altitude Illness

"C"   Cognitive Performance

"ENV"   Environmental Factors

"IND"   Individual Factors

"INFO"   Information

"MSN"   Mission Factors

"P"   Physical Work Performance

"RISK"   Risk

app   application

ARL   U.S. Army Research Laboratory

DASR   Determination of Altitude Sickness Risk

DISA   Defense Information Systems Agency

DOD   Department of Defense

GPS   Global Positioning System

GUI   graphical user interface

MAS   Mobile Application Store

TB   Technical Bulletin

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